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Account of the WHYNN DYKES in the Neighbourhood of the GIANT'S CAUSEWAY, BALLYCASTLE, and BELFAST, in a Letter to the LORD BISHOP OF DROMORE, from WILLIAM RICHARDSON, D. D. late Fellow of TRINITY COLLEGE, DUBLIN. Read, April 12, 1802.

MY LORD,

When I last had the honour of conversing with you on basalt subjects, you were surprised when I told you that the *Whynn Dykes*, which of late have so much occupied the attention of naturalists in the Western Isles of Scotland, originated on our Irish coast, and especially about the Giant's Causeway.

As your Lordship expressed a wish for further information on the subject, I promised to communicate to you such observations as I should make when I had examined the coast a second time, in order to ascertain the *facts* with the utmost precision.

Previous to my entering into a particular account of our dykes, I will take the liberty of making a few general observations on those in both countries.

The Whynn Dykes in the Hebrides are seen under very different circumstances from those on the northern coast of Ireland. There they are found on, and above, the surface, generally a few feet; and often serve as fences, whence they obtain their name. In this form they run northwards quite to the extremity of these islands, ascending and descending mountains, crossing seas, and where these are narrow, the Dykes that run into the water at one side of a channel, are seen rising out of it at the other side, steadily pursuing their formed rectilineal course.

With us they are sometimes exhibited in a very different manner. Their first appearance is in the faces of our vast perpendicular precipices,
where

where they are seen cutting vertically the several strata of which these are composed, and then burying themselves in the northern ocean.

The observations made on these Whynn Dykes in the two countries, taken together, make our information on the subject complete. In the Hebrides we are surprized at the incredible length to which these mighty walls proceed, and we see them penetrating indifferently all substances they encounter: with us we can measure a part, and a part only, of their stupendous height, as at the Milestone one hundred feet, at Port Spagna three hundred and thirty, at Fairhead probably more: and we can observe the effect, or rather the non-effect, produced at their contacts with the different materials they meet, as they are seen in the faces of our precipices.

By Mr. Mills's account, (Phil. Trans. 1790.) the island of Lismore, entirely limestone, is crossed by Whynn Dykes, as is the limestone at Gartnefs; at Iona granite is the contiguous matter, at Juva chert, at Perfabus a Whynn Dyke is crossed by a lead vein, and another at Glasgow Beg; at the isle of Arran Mr. Jamefon finds them cutting through porphyry and micaceous shistus.

With us the Whynn Dykes at the westward of the Giant's Causeway cut through strata of table basalt, and red ochreous matter, placed alternately; at the Giant's Causeway, and Port Spagna, they cut through strata of finer basalt, disposed in prismatic pillars; while at Fairhead they encounter new materials, to wit, alternate strata of freestone and coal.

In both countries these mighty walls are always of basalt; their general thickness is from twelve to fifteen feet, though in one or two instances they do not exceed two or three feet, and at Gartnefs the Whynn Dyke is twenty three yards across; but it has not been ascertained in any instance to what depth they reach beneath the surface, even in the deepest mines.

Though the material of which these walls are composed seems to be in general the same, yet from Mr. Mills's account, there are important differences between the Scotch Whynn Dykes, and with us scarce any two of our Dykes, that are accessible, exactly (as will appear) resemble each other.

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As the Whynn Dykes, Mr. Mills observed, are unquestionably basalt, he calls them all lava, and attempts to prove it by a sort of vague induction; page 75 he says Ilay Whynn Dykes resemble those at Ballycastle, *which take their rise in a country confessedly abounding with volcanic matter.*

Now the specimens from the Ilay Dykes strongly resemble (as he says) the Derbyshire toadstone, formed, as he asserts (page 98), by subterraneous fire.

Of Derbyshire I will not presume to say any thing, having never visited it, but the proof of its strata being lava, rests upon the admission of Mr. Whitehurst's position, that these toadstone strata were formed by successive eruptions of a volcano at the centre of the earth, which pouring up repeated torrents of liquid lava, these spread when they approached the surface of the Earth at different distances, and formed the toadstone strata.

When Mr. Mills endeavours to establish his opinions by assertions relative to my country, I will venture to reply to him.

The precipice from which the Whynn Dykes issue at Ballycastle, by his own account, consists of alternate strata of freestone and coal, not very like volcanic matters: and as to his positive and general assertion, that our basaltic country *confessedly* abounds with volcanic matters, I must reply in his own style, positively and generally, that it does not afford a single particle of volcanic matter; that I have examined this tract for a longer time, and probably with more attention than any other person ever did, or I would not presume to hazard the assertion so confidently.

When your Lordship is so good as to perform the promise you made me, of spending some time with me at the Giants Causeway, you will be able to judge for yourself as to the truth of these contradictory assertions.

The advocates for igneous operations over the surface of our globe are so prejudiced, that it is sometimes sufficient to refute them merely to quote their own words. As Mr. Mills's paper is now before me, I will give your Lordship an instance: he says page 98. "In short,

“ short, from the very rude and irregular appearance of the summit of the hill (Loffit Hill), from its rising so suddenly from the limestone strata, and from the Whynn Dyke that runs through it, I am strongly inclined to believe it of volcanic origin.” Now, as limestone and volcanic matters are not very congenial, and as we do not find that a Whynn Dyke has been met with in the neighbourhood of any volcano, I conceive, with great deference to Mr. Mills, that if he was determined to draw a conclusion from these data, it should have been a contrary one. But it is time to proceed to facts.

The westernmost Whynn Dyke I have met with on our coast, is near what is called the Black Rock, at the end of the Bush Strand. The perpendicular precipice is there not very high (probably sixty feet), it is composed of horizontal strata of table basalts, separated from each other by red ochreous layers.

The Dyke, (which is inaccessible) is seen from the water to cut all these strata vertically, each of them being interrupted in its course by this wall, and resumed on the other side of it, precisely at the same level.

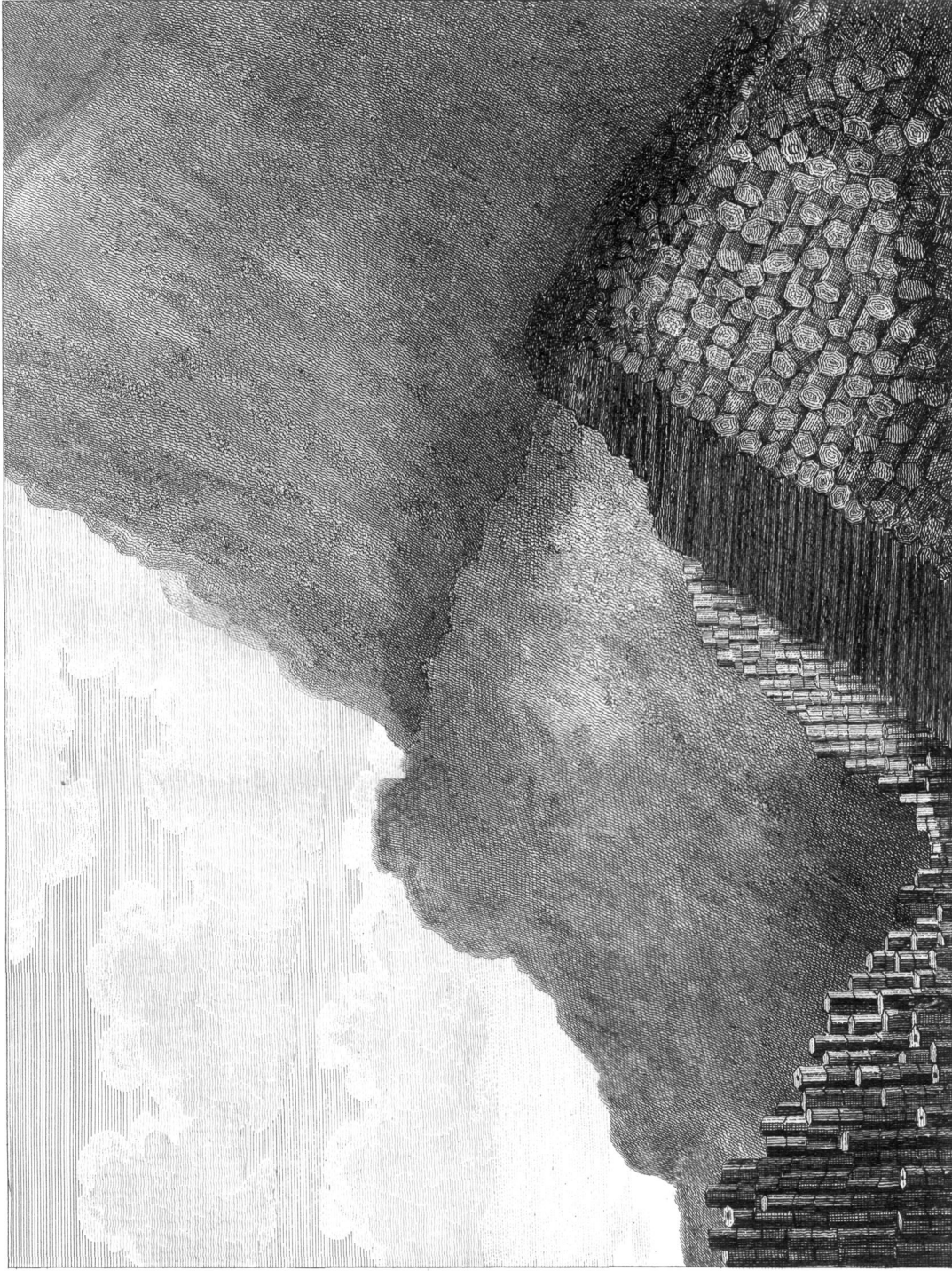
The second Dyke is three or four hundred yards farther on, towards the north-east; it is a much finer one, and so happily marked that it cannot be mistaken.

A solitary rock, about two hundred yards distant from the main, and visible from a great part of the coast on each side, is called the *Mile Stone*, from its supposed distance from the Giant's Causeway, but in reality it is much nearer to it. The precipice here has considerably increased in height, being near to one hundred feet, accurately perpendicular, and stratified as at the other Dyke.

This second Dyke reaches from the summit to the water, beneath which we can see it continued northwards, until it reaches the Milestone, which is a part of it.

Though this Dyke be also inaccessible, it is plainly formed of prisms laid horizontally, and extending quite across; its thickness seems to be about twelve feet.

The



View of a WHYNN DYKE at the Giant's Causeway.

The strata are interrupted here, and resumed again, without disturbance, at the other side, as before; nor in either case does the slightest separation appear where these Dykes meet the contiguous strata, all forming one solid mass.

The third Dyke is situated near the western point of the bay, by which we begin to descend to the Giant's Causeway; of this an isolated fragment alone remains, about one hundred feet long by fifty feet high; like the rest it is composed of rude prisms laid horizontally.

Our fourth Dyke is at the Giant's Causeway itself; it divides vertically part of the cliff, at the foot of which the causeway is situated, and descends quite down to it.

The precipice is not perpendicular here, as at the other Dykes, by which means our view of this one is partially interrupted; there is, however, enough of it laid bare, to ascertain its nature beyond a doubt, and especially as it is composed of horizontal prisms, a property that seems essential to all Whynn Dykes.

Where this Dyke divides the upper part of the columnar stratum which forms the Giant's Causeway, the basalt pillars on the west side of it have fallen from their original vertical position, until they lean forward almost horizontally; while on the east side of the wall they stand steadily vertical.

The basalt septs, which frequently divide the strata in mines, and appear to be of the same nature with our Whynn Dykes, are generally attended by a sinking or subsiding of the strata on one side of them, without disturbing the parallelism of these strata. This too is the case with our own Whynn Dykes at Fairhead; but of the six Dykes at Bengore promontory this fourth is the only one where any thing like a subsiding or depression of the strata can be observed.

This Dyke is so accessible, that we are enabled to examine its material and internal construction, from which we are precluded in the former cases; the basalt of which this is composed, though contiguous to, or rather mixed with the Causeway-pillars, is very different from the Causeway-basalt, it is somewhat coarser, more granular in the fracture, and though darker than the grey whynn-stone of the Fairhead

pillars, it resembles their colours, more than the fine blue of the Causeway-basalt.

The Causeway-Dyke is fifteen or sixteen feet thick, sometimes quite solid, sometimes shivery, it is entirely composed of small trapezoidal prisms, their sides about an inch each, and their axes horizontal, they are strongly agglutinated together, and when this wall is attacked by the fledge, it sometimes breaks into fragments composed of an accumulation of the smaller prisms, abundance of which are scattered about the foot of the precipice.

The fifth Dyke is at the eastern point of the semicircular bay, of which the Giant's Causeway forms the western point; it is inaccessible, and visible only from the water, it cuts vertically three or four strata of table basalt, also a great stratum of red ochreous matter, and is then lost in the precipice.*

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* When I discovered this Whynn Dyke in the year 1801, I was prevented from examining it accurately by an heavy surf, which deterred me from venturing among the sunken rocks at the foot of the precipice; the next summer I was more fortunate, and enabled twice to reach the bottom of the cliff, where the Dyke immersed into the water perpendicularly.

I traced it downwards as it cut the horizontal strata of table basalt vertically, and observed each of these merging into its solid mass without any the least separation of the material; each stratum, having then as it were passed through the Dyke, resumed its former position on the other side at the same level it held before; about forty yards from the place where the Dyke immersed in deep water, it arose again ten or twelve feet above the surface, continuing its course due north for thirty yards, exactly like a wall, shewing the horizontal prisms of which it was constructed, whose bases formed the surface of the wall.

The most curious part of this Dyke is discovered by tracing it up the cliff, whose summit it reaches a little to the eastward of its original course; here it projects boldly from the face of the rock like the rectangular corner of a mighty wall about twenty feet thick: yet this curious wall is not entirely Dyke, but only its west side, which, at its termination, shews the horizontal prisms composing it; the east side is formed by a range of vertical pillars fifty feet long, part of a great columnar stratum which the Dyke there cuts through.

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The sixth Whynn Dyke is at Port Spagna, the third semicircular bay east from the Causeway; this is the only one of our Whynn Dykes that has ever yet been noticed. Mr. Mills, (Phil. Transf. 1790,) saw from the top of the cliff *a kind of a Whynn Dyke, which ran into the sea towards the N. N. E.*; but he did not go down to examine it, and it is from below only that any observations can be made upon it.

This Dyke runs into the sea, like a quay about twenty feet broad, formed of huge black stones; its direction near the water is S. S. W. and its two sides accurately parallel; having proceeded thus about sixty yards from the water, the eastern side deflects a little, forming an obtuse angle, while the western side proceeds farther in its former direction; the breadth of the Dyke thus encreases for a little, but the western side is soon resumed parallel to, and at its former distance from the other

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side

The upper surface of this tremendous wall is easily approached from the top of the hill, and covered with high verdure; I have frequently dined upon it, as fortunately the surface is hollow in the middle, by which the dread of a perpendicular precipice, above two hundred feet high, (and on three sides not more than eight or ten feet distant) is considerably abated; the height of the point of the wall from the sea immediately under it is three hundred and twenty feet.

I dwell upon this Dyke both because it is so easy of access from above, (for even carriages can drive to the edge of the cliff) and also because it is so happily marked as not to be mistaken; it forms the middle point between the Giant's Causeway and the solitary pillar-called the Chimney, or in other words the common horn of the two crescents or semicircular bays next to the Causeway on the east side.

I will add an account of another Dyke lately discovered by my friend Capt. R. O'Neil; it is situated three or four hundred yards N. W. from the beautiful villa called Seaport on Port Ballinistay, a mile and a half west from the Giant's Causeway.

The face of the precipice here seems about fifty feet high, composed of horizontal strata of coarse basalt or trapp, abounding with zeolite, and of a reddish tinge, friable, and decomposing; all these strata, from the summit to the sea, are cut through obliquely at an angle of about forty five degrees, by a Dyke of sound blue basalt, very fine at its edges, but coarser in the middle, and nearly five feet thick; the fine basalt of this Dyke and the coarse trapp of the strata, notwithstanding the difference of their grain, unite solidly on both sides of the Dyke; this important fact is more easily ascertained here, than in any other Dyke I know, it is so accessible; I must observe, that this Dyke is not accurately rectilinear.

side, and the Dyke proceeds now due south: all this is best explained by a figure.



The Dyke, after having proceeded a short way in its new direction, is lost under the rubble that has fallen from above; but whenever the precipice becomes perpendicular, it appears again in its last direction, cutting the strata vertically from the bottom of the precipice to the top, above two hundred feet; the height of the upper part of the cliff above the sea is here three hundred and thirty feet.

These strata are almost all columnar, and the horizontal prisms of the Dyke are strongly contrasted with the vertical pillars of the strata.

The basalt of this Dyke is very nearly of the same grain with that of the Dyke at the Causeway, rather coarser, its fracture granular, and full of shining points; but it differs materially from it in another respect, the latter having but one principle of construction, to wit, the minute prisms into which it breaks, and the agglutination of these forming it into a mere wall; while the Dyke at Port Spagna has, like some other varieties of our basalt, a double principle of construction, being first formed into huge massive prisms four and five feet in diameter, and these again being divided into small quadrangular prisms whose sides do not exceed an inch.

This property possessed by some varieties of our basalt, and other curious circumstances attending them, as for instance, that some of our prismatic basalt in thin strata, abound with marine exuviae, shells and impressions of cornua ammonis,* while others, columnar and prismatic,
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* The nature of this stone is, I know, not yet fully ascertained. Sir Joseph Banks informs me, that the specimens I sent to him, are pronounced by his friends not to be
genuine

but not articulated, and others columnar, prismatic, and articulated; contain cavities full of fresh water to the amount of a thimble-full; all these facts have hitherto escaped notice.

Naturalists, who visit our coast rarely, allow themselves time enough to examine any thing, and, while there, are occupied in looking for arguments to support the theory they patronize, not in studying nature for information: they never examine any of our basalts but that at the Giant's Causeway; this, it is true, has none of the properties I mention, it has but one principle of construction, to wit, the visible prismatic form so much admired, this afterwards breaks indifferently in all directions.

To return to my subject; though the basalt septs in mines in general, and every one of our own Whynn Dykes at Ballycastle, are attended by a depression of the strata on one side; yet those I have described at Bengore Head are accompanied by nothing similar, except the one at the Causeway, and proceeding farther eastward, coasting this promontory, we meet with three depressions of our strata, where nothing like a Whynn Dyke is to be found.

The first is singular and beautiful; it is near a mile east from the Causeway, and a quarter of a mile beyond the last Dyke. The precipice here is uncommonly magnificent, its height more than three hundred and fifty feet above the water; and the upper part of this, which is accurately perpendicular and extends half a mile on either side, is one hundred and fifty feet.

This whole face is composed of three strata, two of them formed of superb basalt pillars forty-five and fifty-five feet long, with an intermediate

genuine or legitimate basalt. An eminent Scotch Naturalist, who visited the spot last summer, I am told, asserts this stone to be *Chert Petrofles* or *Schistus*.

On the other side, Mr. Kirwan, to whom I gave specimens, asserts in a late publication, that it is basalt; our ingenious Mr. Higgins is of the same opinion, and the celebrated Professor Piçet of Geneva, who did me the honour of a visit last summer, considers it to be basalt, containing a greater portion of *fìlex* than usual; I believe Monf. Piçet is right.

diate stratum, near sixty feet of another variety of basalt; the lowermost of these strata, when produced westward, dips, and at its intersection with the sea forms the Giant's Causeway.

This grand facade, together with the whole promontory, is as it were cut down and bisected by a vertical plane, on the west side of which the promontory and all its strata have sunk and subsided about forty feet, without any other shake or disturbance, all the strata in the subsided part still remaining accurately parallel to the permanent strata, and proceeding westward in their former direction, only from points forty feet lower.

An account of the variety, arrangement, and alternations of these strata, so completely displayed in the superb face of this precipice, where nature seems to have intended to exhibit to the philosopher the order in which she has disposed her materials, without putting him to the trouble of penetrating into the bowels of the earth; would lead me far beyond the limits of a letter. How these strata, with their ascent, culminations, dip, and immersions, have hitherto escaped the observation of naturalists, is quite beyond my comprehension.*

The two depressions farther east are much inferior to this; I shall only observe that there is not the least appearance of crack or disruption, the strata (at Portmoon 8) on both sides of the depression are all consolidated into one mass.

When searching for Whynn Dykes upon our northern coast, I was obliged to omit about four miles of it lying between Bengore-Head and Carrickarede, as being too distant from Portrush and Ballycastle, where I was used to take boat, and totally void of shelter, even for the smallest craft.

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* I cannot avoid quoting a passage from a late traveller, who seems to possess two qualities very necessary in a naturalist, to wit, *attentive observation* and *freedom from system*; he says, "no subject is more interesting or useful than an examination of the internal position of strata and veins; in short, upon this is founded all our knowledge of geology; it is, however, attended with great labour and difficulty." (*Jameson's Mineralogy of Scotland and Arran*, page 61.) With us such an examination is attended neither with labour nor difficulty.

To the westward of Ballycastle I saw only one Dyke. On the east side of Kenbaan Point, a rock emerges from the water, which I have no doubt is part of a Dyke, from the appearance it made; and as I approached it, I perceived it was formed of horizontal prisms: here too a new feature occurred, common indeed in the Dykes farther eastward, but which I had not observed in any of those I had yet examined; the centre and sides of this one were constructed differently, the prisms in the centre being larger than those in the sides, and all very neat, the grain too probably, as in other cases, also differed, but I was precluded from examining any of the circumstances which attended this curious little solitary rock, by the violent surf which then broke upon it.

Hitherto the precipices cut through by the Whynn Dykes, and the rocks from among which they sometimes emerge, were all basalt, uniformly stratified, but the accumulation of these strata, after regularly dipping, immerses beneath the sea to the westward of Ballycastle, and a new system of materials arises at the end of the strand to the eastward, to wit, alternate strata of freestone and coal; these are cut through exactly in the same manner the basalt strata were, by vertical Whynn Dykes, which all run into the sea, across the beach at the foot of the precipice.

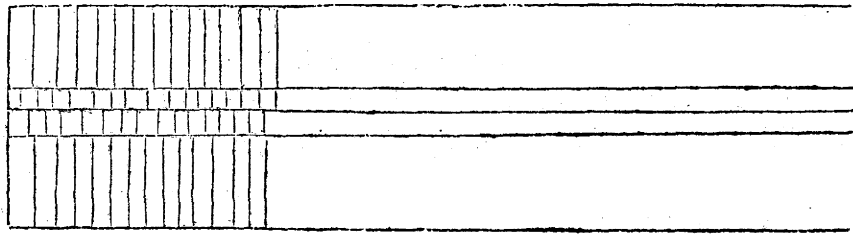
The first of these is about two miles from Ballycastle, and though a rude imperfect one, it is not to be overlooked; the black or dark blue of the basalt being strongly contrasted with the brown colour of the freestone it passes through on the beach; here the high road runs close under the precipice, and affords a good opportunity to examine the contacts of the basalt Dyke with the freestone it cuts through.

The next Dyke, some hundred yards farther east, is more perfect, and so accessible on the beach, that its singular construction can be examined without any trouble; it is of the same breadth with most of the others, that is, about twelve feet; it more accurately resembles a quay than any of them, its surface is flat and its sides perpendicular, it is divided in its whole length by three right lines one bisecting

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it through its middle, and one on each side of this, about a foot distant.

These three lines determine the stile of masonry (if I may use the expression) with which it is built, to wit, horizontal prisms about five feet long, laid in rows on each side, and in the middle two rows of prisms about one foot square each. I attempt a sketch of these lines thus:



The bases of the long prisms shew their polygonal figures on the sides of the Dyke, and, if taken up and laid horizontally, would exhibit a rude pavé; these prisms are obviously composed of smaller ones like those at Port Spagna, but I had not a sledge sufficiently weighty to ascertain the fact with precision.

When I was on the spot Mr. Magawly, who is concerned in, and superintends the colliery, told me they were then cutting across this Dyke seven hundred yards within the precipice.

The next Dyke is of ruder basalt, and more imperfect; it seems to exhibit nothing remarkable.

The fourth Ballycastle Dyke, or as it is called there the Great Gaw, emerges from beneath the precipice, of the same breadth and of the same rude material and construction with the first and third; but it is soon joined by what the colliers call its wing, that is a new wall annexed to it on each side, by which it becomes triple; these wings are of a very different material from the centre, being precisely the same in grain with the very fine Portrush stone, which sometimes contains shells and impressions of *cornua ammonis*, but in these wings I did not observe any.

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When this Dyke enters the water it accumulates into an island, or rock, of much greater height and breadth, still the two materials keeping distinct, though so united at the contact as to form but one stone; thus the arrangement of the coarse, and very fine, basalt here and at Portrush, are precisely the same, saving only one difference, that at the latter place the planes of the strata are horizontal, while at the Great Gaw of Fairhead they are vertical, and in both places grow into each other without interrupting the continuity, or solidity of the material, yet leaving the line of demarcation distinct.

Though the precipice at this part of Fairhead be not so accurately perpendicular as at Bengore, yet the depression of the strata on one side of this Dyke is visible from the water, and what is curious, a range of massive pillars, near one hundred feet each, appears over the permanent part, while over the depressed part nothing is to be seen, whence it is plain that these strata have not been depressed by incumbent weight.

The miners tell me there is also a fifth Dyke here, faintly marked without the precipice, while the Gaw, or sept, within the mine is to them very important, and has also its depression on one side, like all the others at *Fairhead*, while at *Bengore head* no depression is found but in the Dyke at the Causeway; all these depressions, as well as those at Bengore, where no Dyke is found, are on the west side of the line, or plane, separating the permanent from the subsided part; I mention this curious fact for the information of geologists who may possibly make some use of it.

These singular walls are not confined to the northern coast of our basalt country; its eastern side abounds with them still more. It was not in my power to examine any of those except such as lie in the bay of Belfast, but my ingenious friend Doctor M'Donald, (a zealous mineralogist, whose pursuits in that line have of late been much impeded by great

VOL. IX.

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success

* I mentioned before that some naturalists have denied this Portrush stone to be basalt; but its being found here in a Whynn Dyke seems strongly to support the affirmative, as I have never heard of a Whynn Dyke composed of any material but basalt alone.

success in his profession) informs me that they commence near Murlogh, where my tour on that side ended; that they are very numerous about Torr point, Garron point, and in general on all projecting points on that coast; and he conceives (I think judiciously) that points being found where the Dykes are most numerous, arises from the protection they give the land in those places, preventing the sea from making the same inroads there it did on the adjacent parts.

Doctor M'Donald and I examined together the Dykes at White-house point four miles from Belfast; several of them are crowded together, three or four run parallel in an E. S. E. direction at about one hundred and fifty yards from each other, and are in one place crossed by another at acute angles; several of these Dykes, (I am told) are traced across the county of Down on the opposite side of Belfast lough.

Though these Dykes were so near, yet they differed materially from each other; in many the middle part and the sides were not of the same grain, nor constituted on the same principle; in some we found zeolite in the centre, but not in the sides, in others the middle part was formed by cutting it across (no doubt into prisms), while the sides were a rude mass studded with coarse round stones, about the size of an eighteen pound ball; these last Doctor M'Donald assured me he had often broken, and found them composed of concentric spheres, like the pellicles of an onion; some of the Dykes were of solid massive prisms laid quite across, while one or two had a longitudinal division running through their middle, as in the second Dyke at Fairhead,

In all the lines marking the construction of the Dykes, whether accurate or faint, were across at right angles to their directions, but the perfection of the workmanship was very different, and when we attacked them with a light sledge, we found some to crumble, being in a state of decomposition, others resisted our efforts, while some broke into small quadrangular prisms, like the Dykes at Port Spagna and the Giant's Causeway.

Doctor M'Donald shewed me in his cabinet prisms he had taken from a quarry (no doubt a Dyke) near Belfast; they were nine or ten inches long, and entirely composed of triangular pyramids of the same length,
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put together as if to illustrate Prop. 7. Lib. 12th Eucl. Elem. I had found two or three small triangular pyramids among the quadrangular prisms at the Giant's Causeway Dyke, but at the Belfast Dyke triangular pyramids were the sole elementary figure.

As the shore in Belfast lough is low, there are but few opportunities of examining the materials that come in contact with the basalt Dykes; in fact I noticed but two, stratified clay and freestone; this clay is very plentiful on the shore and the adjacent country, it is arranged in very thin horizontal strata, and when exposed to the air hardens almost to the consistence of stone.

At the contact the basalt and freestone were strongly united together, and for two or three inches the basalt had in some sort acquired the colour and grain of the sandstone; I was particularly attentive to this fact as Mr. Werner alledges the transition of basalt into other stones, and Mr. Jamefon found in Arran (pages 131 and 135) basalt sometimes mixed with, and at others penetrated by sandstone; but on this occasion Doctor M'Donald by some experiments, found that notwithstanding the freestone appearance, the stone remained pure basalt.

The basaltic area, from the north and east sides of which these singular walls diverge in such abundance, comprehends a considerable part of the county of Derry, and a much greater of the county of Antrim; its breadth varies from twenty to near thirty miles, and its length exceeds thirty-five; it seems composed almost exclusively of vast and steady basalt strata accumulated upon each other; in one place we count sixteen, in others we conjecture more, especially at Magilligan rock, as we know the basalt to be twelve hundred feet deep there. This whole mass rests upon a vast stratum of white limestone about two hundred feet thick, of the same extent with the basaltic area, but discoverable only at its periphery, which extends above eighty miles.

This mighty stratum ascends to the southward, until its lower edge acquires on the east side an height of eight hundred feet, and on the west at least seventeen hundred; the country below the limestone stratum, and without

it, is on the west side mostly schistus, on the east sand stone and clay penetrated by basalt Dykes, which furnish stones in abundance for all purposes.

The Scotch Whynn Dykes have been generally supposed to originate in Ireland. If this fact be admitted, we can easily trace them by attending to the directions of our own; thus those that issue from the coast west of Ballycastle, proceeding north with a slight inclination to the east, are to be sought for in Islay, Jura, Mull, &c., where Mr. Mills actually found them in great numbers.

Our Dykes which are seen at Murlog, Torr, and Cushendun, are obviously those which, having crossed the Mull of Cantyre, were observed by Mr. Jameson in such abundance in the Isle of Arran.

Dr. Hutton also mentions twenty or thirty Whyn Dykes he found "in the shire of Ayr to the north of Irvine on the coast." These correspond with the numerous Dykes about Garron point and its neighbourhood, whose rectilinear course is directed towards that part of the Scotch coast.

The Dykes about Larne may be expected to be found on the Mull of Galloway, while those I examined far up in Belfast lough, on account of their S. E. direction, probably do not catch Scotland, nor meet land until they arrive on the coast of Cumberland.

Whether our Whynn Dykes be *identically* the same with those on the Scotch coast opposite, is not easily ascertained, though highly probable; but even confining ourselves to our own country, we find sufficient matter for astonishment in contemplating our basaltic area, formed by accumulations of horizontal strata, with numberless vertical planes radiating from it; had Dr. Beddoes been acquainted with this structure of our basaltic country, I think he would scarcely have asserted, that "a right knowledge of basaltes is conducting us fast to a just theory of the earth." I think very differently from Dr. Beddoes, and conceive that instead, of *assisting*, basaltic facts are throwing new difficulties in the way of cosmogonists, who flatter themselves they have developed the secret of nature; and that those in

my

my country, (to which I confine myself) are utterly irreconcilable to any theory I have met with.

Two sects of naturalists, distinguished by the names of *Volcanists* and *Plutonists*, have of late taken possession of all the basalt in the world, and have divided it between themselves, under the descriptions of *erupted* and *unerupted lava*; and they have so convinced Dr. Beddoes of the validity of their claim, that he says, “ I shall assume the origin of basaltes “ from subterranean fusion to be thoroughly established.”

After such a round assumption it may be deemed uncivil to question the igneous origin of our basalt Dykes; but natural history is not to be sacrificed out of respect to confident assertion; I will therefore try by the test of *facts* whether that description of basaltes (which your Lordship wishes for information upon) ever was in fusion.

Foreigners seem to know little of Whynn Dykes except in mines. Mr. S. Fond found at Chamarelle in Vivarois, what is obviously a Whynn Dyke, and it embarrassed him more than any fact he ever met with; it will be found entertaining to look into his *Vol. ex. de Vivarois*, and into his *Min. des Vol.* to see the difficulties into which this *courant de lave compacte* this *ruisseau de basalte en fusion* has thrown him, and the swinging postulates he is obliged to make, in order to get over them.

Dr. Hamilton on behalf of the *Volcanists*, and Dr. Hutton, the great advocate for the *Plutonic* system, are more ready at their expedients; the first of these forms our Whynn Dykes by pouring in erupted lava at the upper aperture of mighty chasms; while Dr. Hutton conceives these chasms were filled up by his own unerupted lava, forced up at the lower.

In discussing the opinions of these gentlemen I will make them the most liberal concessions; for instance, I will concede to both, that they have discovered the process by which nature has formed chasms of immeasurable length, immeasurable depth, and of inconsiderable, though uniform, breadth.

I will concede to Dr. Hamilton that he has brought to the edge of the chasms his lava, “ this foreign substance, which issuing from the vast
“ mass

“ mafs of bafaltes that forms the northern extremity of Fairhead, has
 “ defcended over the adjoining ftrata,” and that he has it ready “ to
 “ fill up each cleft and vacancy.” (Ham. Antrim. let. 5 part 1.)

I will alfo admit in favour of Dr. Hutton, that he has his unerupted
 lava ready at the bottoms of thefe chafms, that he has his machinery
 prepared for forcing it up, and that he has furmounted his great difficulty,
 and difcovered a mode of fupporting fuch a mafs when raifed; a point
 upon which, having failed himfelf, he would difcourage others from form-
 ing conjectures. (Edinburgh Tranf. vol. 1 page 285.)

Notwithftanding thefe concessions it will not be difficult to fhew that
 thefe gentlemen have not difcovered the fecret of nature in the construc-
 tion of thefe fingular walls, and that they were not formed by liquid
 lava filling up mighty chafms.

1ft. Many of our contiguous Dykes differ materially from each other,
 yet their proximity is fuch, that according to the theory of either Dr.
 Hamilton or Dr. Hutton, they muft have been filled up from the fame
 fource, and with the fame material.

2dly. Many of thefe Dykes, both in Ireland and Scotland, fhew a
 material difference between their middle parts and their fides, both in
 grain, and internal principle of conftruction; the change too is not gra-
 dual, but per faltum, as if the diffimilar parts were feparated from each
 other by planes parallel to their fides; all this is perfectly incompatible
 with the high ftate of fluidity in which the lava muft have been, to
 enable it to fill up vaft chafms of fuch diminutive breadth.

3dly. Our Whynn Dykes come in contact with a great variety of dif-
 ferent fubftances, without producing fuch effect upon any one of them,
 as might be expected from the contiguity of fo glowing a mafs; but
 however this argument may bear againft the *Volcanifts*, the *Plutonifts*
 will fay it does not apply to them, for the chemical operations of nature
 are carried on in Dr. Hutton’s fubterranean laboratory very differently
 from what we fee on the furface of our globe, in the former Dr. Hutton
fays calcareous ftrata are confolidated by the operation of heat and fimple fusion,
 and again, *having proved that thefe ftrata had been confolidated by fimple*
fusion

fusion. (page 253). Dr. Hutton however confesses it is not easy to comprehend this: "and to be convinced that this calcareous stone, which
 " calcines so easily in our fires, should have been brought into fusion by
 " subterraneous heat without suffering calcination, must require a chain
 " of reasoning *which every one is not able to comprehend*." (Page 271.)

But it is not necessary on this occasion to enter into the mysteries of a laboratory, to which we have not access, nor to calculate the force of Dr. Hutton's great agent *compression*; for our observations on the contacts of the matter of our Whynn Dykes with the substances they encounter, being made on the surface of the earth, in the open air, even admitting those Dykes to be formed as Dr. Hutton supposes, his un-erupted lava is now become erupted, and of course, to use his own words, "those substances which calcine and vitrify in our fires, should suffer
 " similar changes when delivered from a compression which renders them
 " fixed." (Edinburgh Transf. page 280.)

I am aware I must fatigue your Lordship by dwelling so long upon the question of the igneous origin of our Whynn Dykes; but as most modern writers and travellers call them *lava veins*, and the *facts* I have observed with much attention, induce me to combat so general and so popular an opinion, I hope you will excuse me for adding a fourth argument, which I conceive to be conclusive.

All substances, when ignited, are in an high state of dilatation; this is followed, when they cool, by a contraction, *une retraite*, by which they occupy less space than they did when heated; of course, had our Dykes been chasms filled up with glowing lava, when this material cooled and contracted, it could no longer fill up these chasms as before, but must crack and separate from their sides, leaving intervals and disruptions; but nothing like this is observed, the Dyke and contiguous matter, whatever it be, are solidly united together, forming but one mass.

These Whynn Dykes suggest other curious questions: Were they formed at the same time with the contiguous materials?

Were they posterior to them as Dr. Hamilton and Dr. Hutton suppose?

Or

Or were they antecedent to the stratified masses, that every where come in contact with them?

The inutility of such speculations deters me from entering into them. I must however confess, that the *facts* seem to give stronger negatives to the two first questions, than to the last; but who would hazard so bold an opinion, as that these mighty walls were the first part of our world that was formed? what an idea must it convey to us of this *frame work* or *skeleton* of our globe?

A new theory I conceive more likely to be a nuisance than an acquisition to natural history; and that the road to the advancement of the science would be better laid open by destroying some of those we have already.

Should therefore your Lordship think that the arguments I have adduced against the igneous origin of our Whynn Dykes are of any weight I will probably make further inroads into the territories of *Vulcan*, and question the igneous origin of basalt in general.

To this your Lordship will very likely reply, that the topic is worn threadbare; that most modern writers, without entering into the question, pronounce it to be already decided in the affirmative; and that I shall never obtain attention to so stale a subject.

My opportunities however to procure information upon it have been superior to those of any other person; I have lived very many summers in the most important basaltic country in the world, and my fondness for the sea, and possession of boats, have enabled me repeatedly to explore our coast, which I know that no other naturalist ever did. It is to this coast and country that the advocates for particular opinions come, to look for arguments to support the theories they patronize; it is painful to follow such gentlemen, correcting their statements, and contradicting their assertions: nor are they cursory travellers alone who misrepresent our facts; it will appear that men of science and ability are equally disposed to support their opinions at any expence; a favourite theory is an adopted child, that must be maintained.

But

But it is not by exposing the errors of others that science, and especially *natural history*, is to be advanced, nor is it by puzzling ourselves to find out in what manner, and by what process, nature has executed her work; let us rather examine attentively what she has actually done; let us quit disputing about the whimsies of our own brains, and study the code of *facts*.

In our basaltic country these are curious, as well as abundant; and it will be from such of these alone as have escaped the attention of my predecessors, and from the geological construction of the country, that the arguments to be applied to the question of the igneous origin of basalt will be drawn; and whatever may be their weight, at least they will have the merit of novelty to recommend them.

I am, with great respect,

your Lordships

most obedient,

PORTRUSH.

humble Servant,

W. RICHARDSON.

P. S. When I found an opportunity for examining the Whynna Dykes to the northward of Whitehouse-point, I omitted several under the demefne called Macedon, which were much covered by sea-wreck; here I knew the surfaces of the Dykes were decomposed, and their distinctive characters defaced.

Between Macedon and Carrickfergus there are many, all as usual differing from each other; some not so rectilinear in their course as those I have hitherto described, in one or two the prismatic construction was scarcely perceivable, while in the greater number the arrangement of these prisms laid across the Dyke was most distinct. In

In two contiguous Dykes I observed, that the axes of these prisms were not horizontal as usual, but in one greatly elevated to the north, and in the other towards the south.

Human attention could not follow the variety which nature has displayed in the formation of these Dykes; therefore, not to fatigue the reader, I will describe but two more particularly; I select these, both on account of the new circumstances attending them, and also because they are easy of access, being within a few yards of the great road from Belfast to Carrickfergus.

The first of these runs eastward along the strand, about four hundred yards south of the gallery; we approached it from the north, and found it composed of long well formed horizontal prisms, lined on the north side by a sort of basaltic wall about eighteen inches thick; this a military gentleman of our party called its *revetement*, I adopt the word on this occasion for convenience.

After we had traced the Dyke eastward for several yards, we observed this *revetement* separate from it, and diverge at a considerable angle, then, forming a curve, disappear beneath the sand to the north-east; this new circumstance exciting our attention, we traced the *revetement* back to the Dyke, then along it to the westward, when after some time we perceived it entering the Dyke at an acute angle, and crossing it diagonally; when across, it formed for several yards a *revetement* on the south side of the Dyke, then diverging from it, and curving as before, it was again lost under the sand to the south-west.

The second Dyke I will describe particularly, lies about five hundred yards north from the *silver stream*, and about three miles from Carrickfergus; it seemed composed of four or five distinct walls, agglutinated together; in each of these the prismatic construction was different from that of the others, and in one the axes of its prisms were not as usual at right angles, but oblique to the direction of the Dyke.

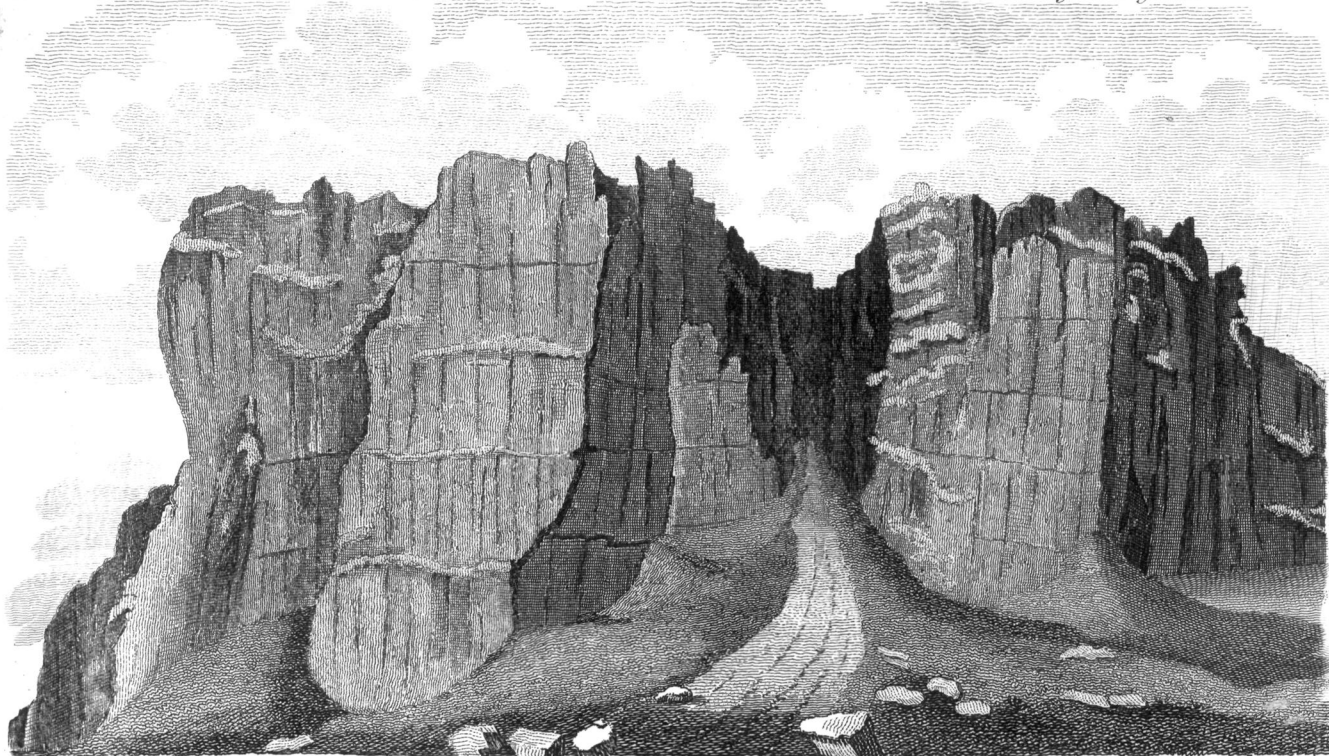
A new circumstance occurred here too; this Dyke, about twenty-five feet broad, had a *revetement* of freestone on each side, and was also twice or thrice penetrated by walls of freestone similar to, and in the same direction

rection with the basalt walls between which they lay; these freestone walls were more than a foot broad, and sometimes composed of horizontal laminæ, and at others of vertical.

I have since discovered a magnificent Dyke in the face of the stupendous precipice of Cave hill* which it cuts vertically near two hundred feet, and is afterwards to be traced a great way down the hill.

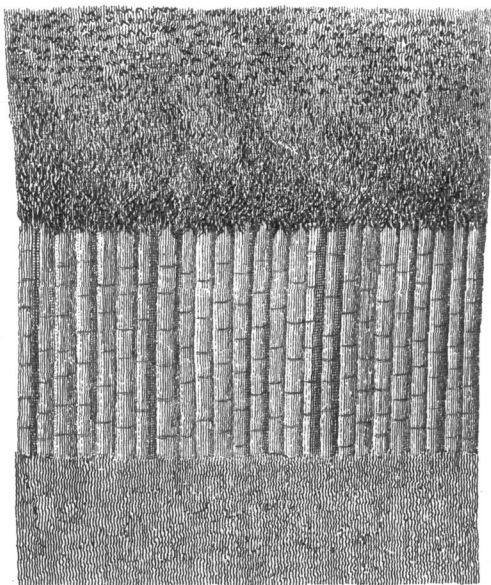
Though this Dyke be attended by very curious circumstances, I will take no further notice of it, as I hope to see it soon accurately described by my ingenious friend Dr. M'Donald, who was with me when I discovered it, and whose vicinity affords him better opportunities of accurately examining this beautiful and interesting façade.

* A stratified basaltic mountain, nearly hanging over Belfast; it is well worth the attention of naturalists.



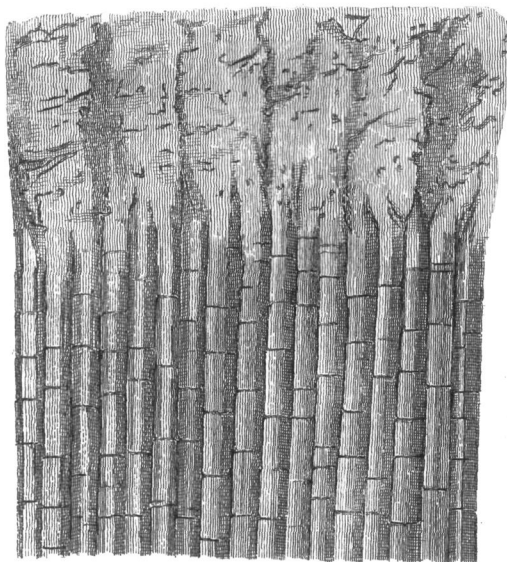
Basalt Precipice, at the Summit of Cave-Hill Mountain, near Belfast.

N^o 1.



*Lower Columnar Stratum with Red Ochre
at Pleskin.*

N^o 2.



*Upper Columnar Stratum at Port Spagua
& Pleskin.*